GUIDE TO THE

FORTY-FIRST ANNUAL FIELD CONFERENCE

OF THE

SECTION OF GEOLOGY

OF THE

OHIO ACADEMY OF SCIENCE

April 23, 1966

DEVELOPMENT, UTILIZATION, AND STRATIGRAPHY OF INDUSTRIAL MINERALS IN NORTHEASTERN PERRY AND SOUTHWESTERN MUSKINGUM COUNTIES

CHAIRMAN OF SECTION

Charles Graham
Denison University
Granville, Ohio

GUIDE PREPARATORS AND FIELD TRIP LEADERS

Staff, *Ohio Division of Geological Survey*

INTRODUCTION

The primary purpose of this trip is to provide an opportunity for the participants to visit a number of industrial operations utilizing raw materials from the lower Pottsville and upper Mississippian. Figure 1 indicates the route to be followed. The brief outline of the bedrock geology which follows was summarized almost entirely from Flint (1951) and those interested in a detailed discussion of the area are referred to this work. Because of the tight schedule required to visit these operations, there will be no chance to examine outcrops except at the regular stops. Data are given, however, for several interesting exposures along the field trip route. It is hoped that, after the final stop, many of the trip participants will wish to visit and examine some of these exposures.

Rocks from the Pennsylvanian Middle Kittanning Coal to the Mississippian Logan Formation are exposed along the route. The Mississippian-Pennsylvanian contact in this area is represented by an erosional surface which in places cuts through the uppermost Mississippian Maxville Limestone and into the Vinton member of the Logan Formation. Flint (1951, p. 19) indicates that the relief on this surface in Perry County is from 50 to 75 feet. Rocks of the Pennsylvanian and Mississippian Systems in this area are easily distinguished from one another, thus making this contact readily recognizable.

The Pottsville and Allegheny Groups of the Pennsylvanian System in this area are composed of a complex sequence of sandstone, shale, clay, and coal, alternating with marine limestones, flints, and ironstones. These beds are normally thin, lenticular, and lack lateral continuity. The lowermost Pottsville units were deposited over an irregular surface formed by pre-Pennsylvanian erosion, thus contributing to the irregular nature and distribution of these beds. Figure 2 illustrates the relationship between strata of the lower Pottsville and the Mississippian in the Licking-Perry-Muskingum tri-county area.

Post-Mississippian erosion has truncated the Maxville Limestone in many places, creating a "patchy" distribution of limestone islands of irregular thickness. This unit, which in places in this region is as much as 42 feet thick, is the basis for a sizeable industry producing cement, agricultural limestone, road metal, and concrete aggregate. Where the Maxville is absent, the uppermost Mississippian beds are assigned to the Vinton member of the Logan Formation. The Vinton member is composed of fine-grained, thin-bedded, ferruginous sandstones and siltstones interbedded with sandy shale, and these characteristics help to distinguish Mississippian units from the coarser, more irregularly bedded clastic units of the overlying Pennsylvanian.

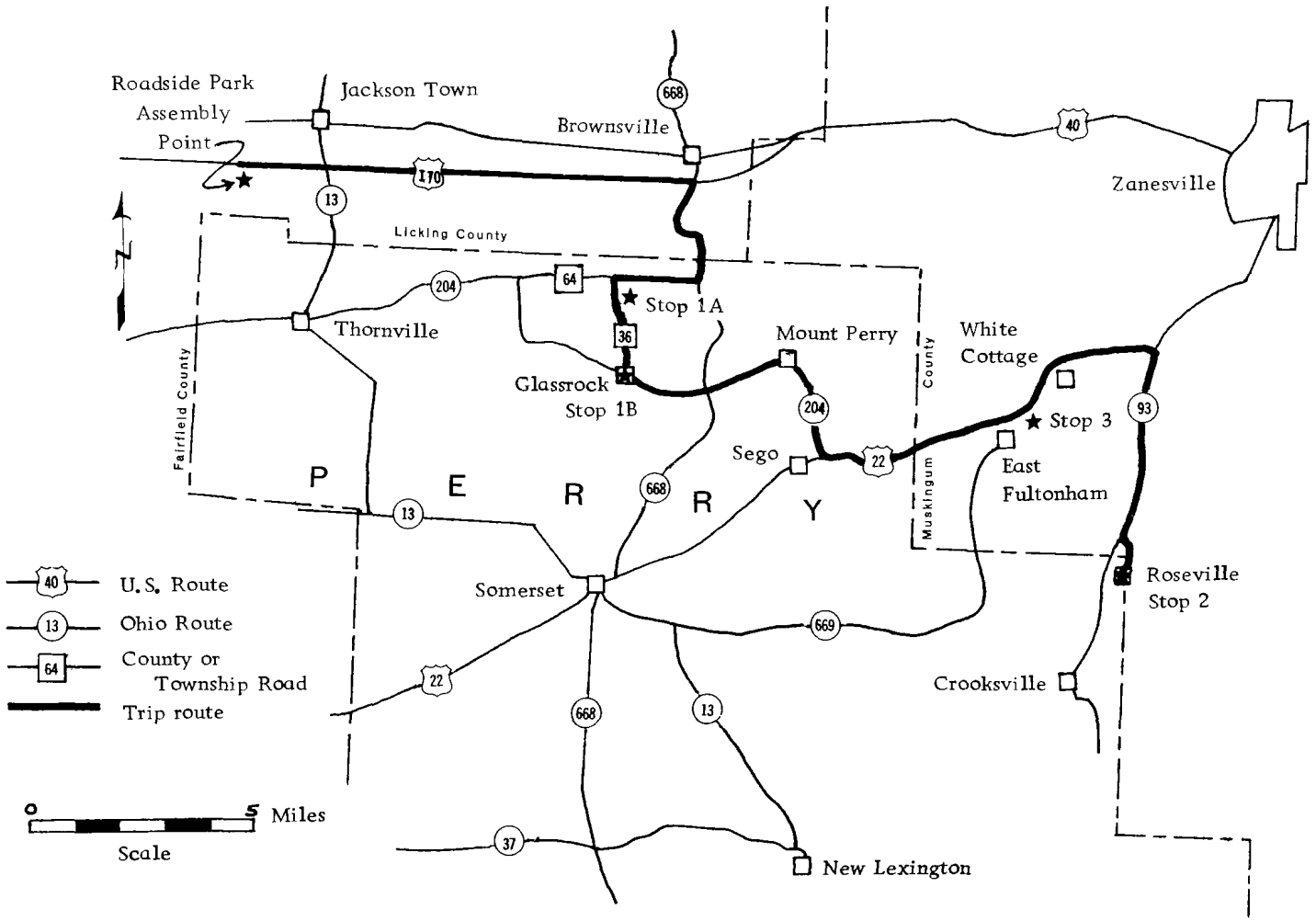

Figure 1

INDEX MAP SHOWING STARTING POINT, ROUTE, AND STOPS FOR
OHIO ACADEMY OF SCIENCE FIELD TRIP, APRIL 23, 1966

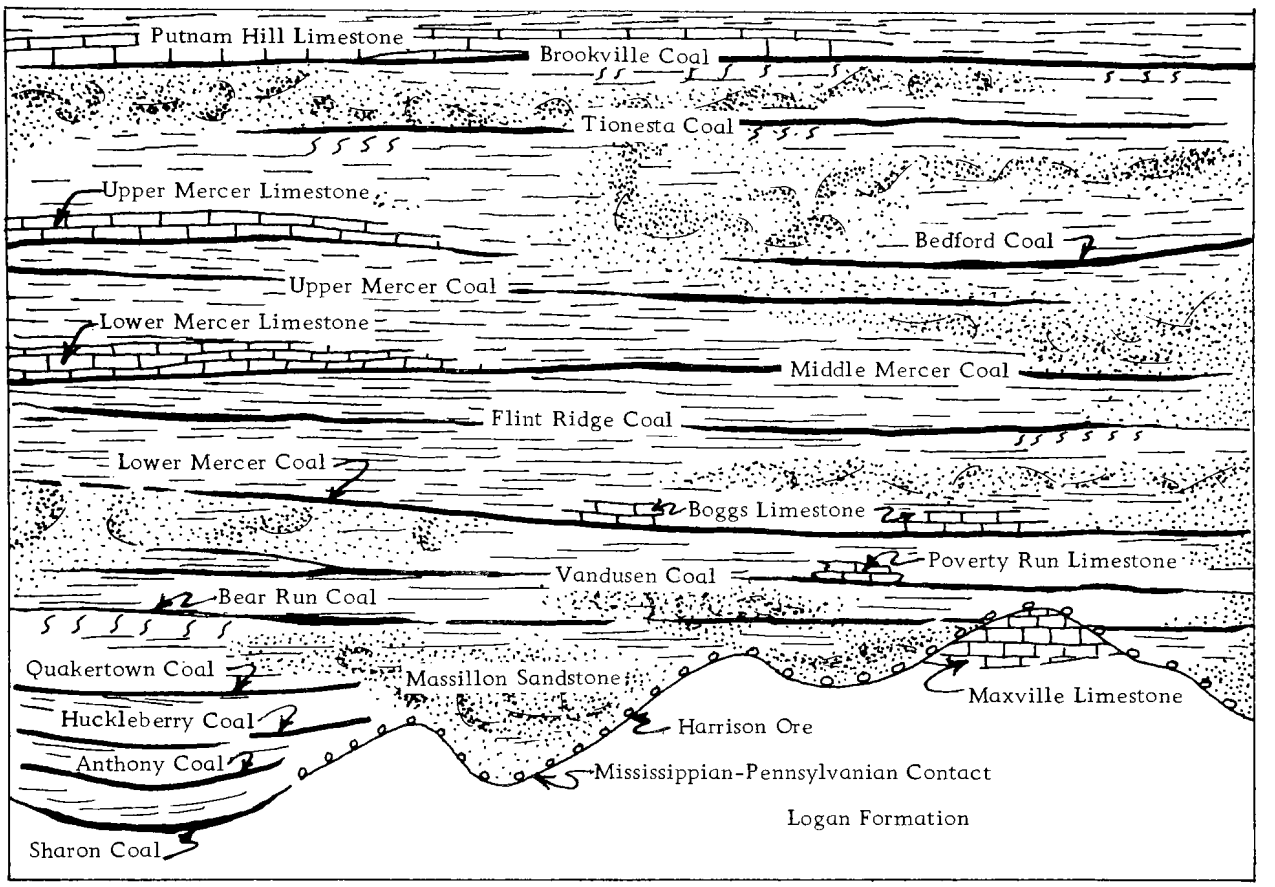

Figure 2

DIAGRAMMATIC SKETCH SHOWING STRATIGRAPHIC RELATIONSHIPS OF MISSISSIPPIAN AND PENNSYLVANIAN STRATA IN THE LICKING-PERRY-MUSKINGUM TRI-COUNTY AREA

ACKNOWLEDGMENTS

We wish to thank Mr. Arthur F. Harrison, President-Treasurer, and Mr. Hiram Heck, Vice President, of the Central Silica Company for allowing us to visit their operation. Thanks are also due Mr. McCoy and Mr. Burgess Fauley, Plant Manager, of the Nelson McCoy Pottery Company for their cooperation in opening their plant to us. Thanks to Mr. Grant Orndorff, Industrial Relations Director, and the Columbia Cement Corporation for allowing us to tour their facility and for preparing our lunch.

GEOLOGY FIELD TRIP LOG

From	Distance	To
Starting point, Roadside Park, I-70, 2 mi. west of Ohio 13 Interchange	10.8 miles	I-70 and Ohio 668 Interchange; turn south on Ohio 668

Numerous roadcuts from Ohio 13 Interchange east along I-70 expose strata of the Logan Formation (Mississippian System) and the Pottsville Group (Pennsylvanian System). Figure 3 illustrates the Pennsylvanian stratigraphy in the principal cuts.

Interchange I-70 and Ohio 668	2.3 miles	Jct. Ohio 668 and Perry Co. Road 64; turn west on Perry Co. Road 64
Jct. Ohio 668 and Perry Co. Road 64	2.5 miles	Jct. Perry Co. Roads 64 and 36; turn south on Perry Co. Road 36
Jct. Perry Co. Roads 64 and 36	0.3 miles	Entrance to Central Silica quarry. STOP 1A

STOP 1A
CENTRAL SILICA COMPANY QUARRY

The unit being quarried at this locality is the Massillon Sandstone. The Massillon, which varies from sandy shale to massive sandstone with conglomeratic lenses, has been quarried in this area since 1886 (Bownocker, 1926, Repr. Ser., p. 12). The sandstone phase of this unit is composed primarily of medium-grained, subangular, glassy quartz grains with secondary crystal overgrowths. Although similar sandstone deposits have been reported in Madison, Reading, Jackson, and Monday Creek Townships, Perry County, the Massillon has been quarried for glass sand only in the vicinity of Glenford and Glassrock, Hopewell Township. Details of the stratigraphy at the present quarry are given in OGS section 14898 (p. 12).

In the quarrying operation, the overburden is removed by the "pan" stripping method, i.e., bulldozers are used to break up the overburden and earth movers to transport the loose rock to the spoil pile. A churn drill is used for drilling shot holes, which are charged with sodium nitrate for

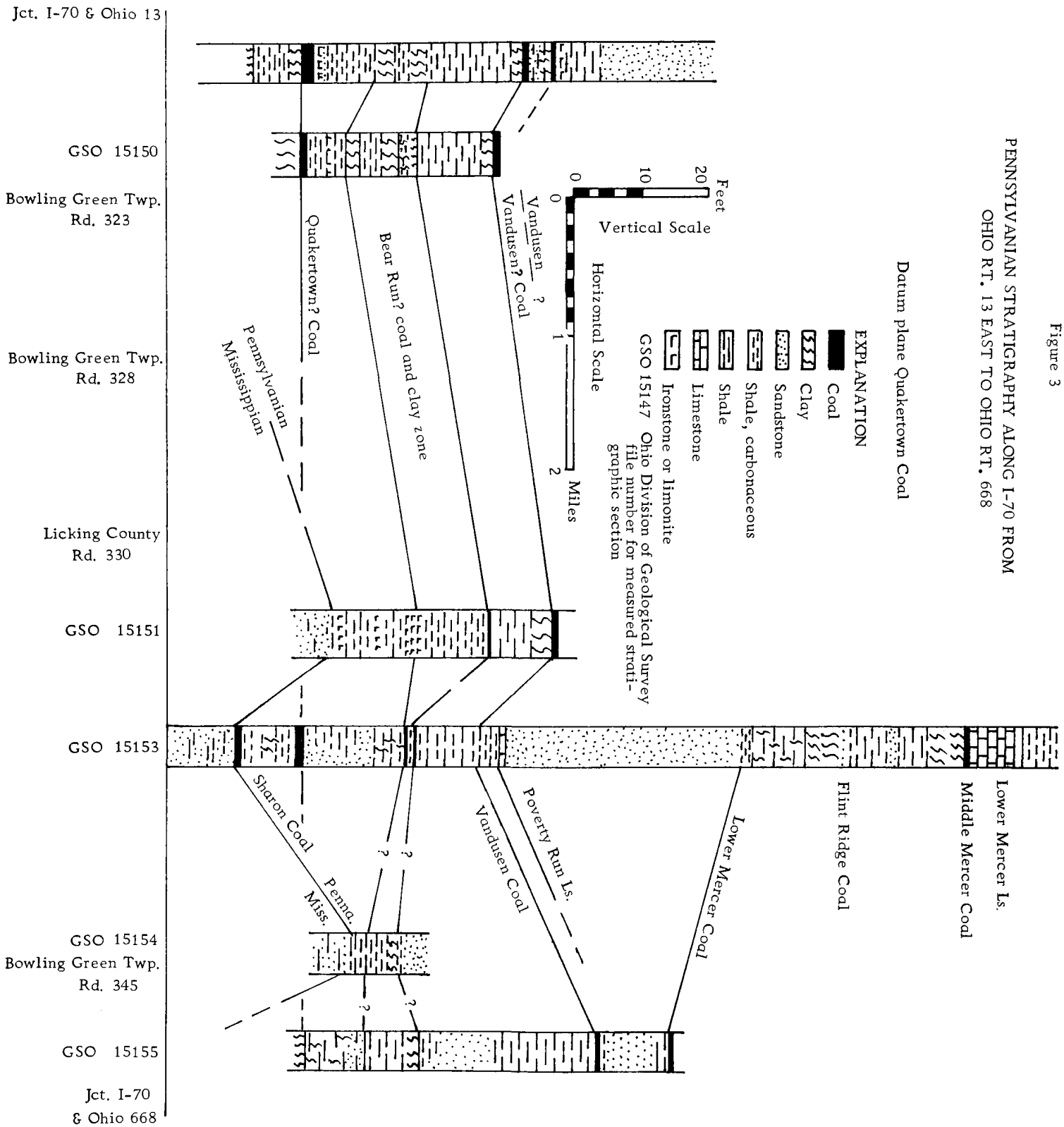
Figure 3
PENNSYLVANIAN STRATIGRAPHY ALONG I-70 FROM OHIO RT. 13 EAST TO OHIO RT. 668
Datum plane Quakertown Coal
EXPLANATION
Coal
Clay
Sandstone
Shale, carbonaceous
Shale
Limestone
Ironstone or limonite
GSO 15147 Ohio Division of Geological Survey file number for measured stratigraphic section
Horizontal Scale
Miles
Vertical Scale
Feet
Vandusen Coal
Vandusen? Coal
Quakertown? Coal
Bear Run? coal and clay zone
Pennsylvanian
Mississippian
Lower Mercer Ls.
Middle Mercer Coal
Flint Ridge Coal
Lower Mercer Coal
Poverty Run Ls.
Vandusen Coal
Sharon Coal
Penna.
Miss.
Jct. I-70 & Ohio 13
GSO 15150
Bowling Green Twp. Rd. 323
Bowling Green Twp. Rd. 328
Licking County Rd. 330
GSO 15151
GSO 15153
GSO 15154
Bowling Green Twp. Rd. 345
GSO 15155
Jct. I-70 & Ohio 668

blasting. A loading shovel and trucks are used to move the rock to a preliminary jaw-type crusher where the rock is reduced to about 5" size. The rock is then transported by means of a 2.2 mile long tramway to the processing plant at Glassrock.

Leave quarry, proceed south on Perry Co. Road 36	2.1 miles	Central Silica Plant at Glassrock. STOP 1B

STOP 1B
CENTRAL SILICA COMPANY PROCESSING PLANT

Rock delivered to the processing plant via the tramway is passed through a crusher and rod mill to reduce it to grain size. Quality control of the product is maintained by flotation and sulfuric acid treatment designed to remove heavy minerals, argillaceous material, and iron oxide. Pulverizing and screening are done to meet sand specifications for both size and purity. The plant capacity is 2,000 tons per day. The chemical analysis advertised by the Central Silica Company for their glass sand is: SiO_2 - 99.60%; Fe_2O_3 - .018%; Al_2O_3 - .27%; TiO_2 - .028%; loss on ignition - .10%.

The glass and ceramic industry takes approximately one-half of Central Silica's total production. Standards for glass sand vary with the product, and some untreated sand is sold for this purpose. Sand sold for metallurgical and industrial uses is also untreated. Tailings are sold for sandblasting, for golf course sand traps, and for miscellaneous other uses. Because of the angularity of this sand, it is not well suited for use in the hydrofracturing of oil and gas wells; for this purpose rounded grains which will roll readily are more desirable.

The markets for this sand are restricted mostly to Ohio because of transportation costs.

Proceed east from Glassrock on Ohio 204	7.5 miles	Jct. Ohio 204 and U. S. 22; turn east on U. S. 22

The Massillon Sandstone can be traced about $2\frac{1}{2}$ miles eastward from Glassrock but is not evident at Mount Perry. Flint (1951) reports an abandoned coal mine in a seam under the Massillon in the $NW\frac{1}{4}$ of section 18, Madison Township. The occurrence of this coal below the sandstone is a major point of evidence for calling this unit Massillon rather than Sharon.

Occasional exposures in the roadcuts near the bottom of the valley of Jonathan Creek expose rocks of Mississippian age.

Jct. 204 and U. S. 22	9. 1 miles	Jct. U. S. 22 and Ohio 93; turn south on Ohio 93

The Pennsylvanian-Mississippian systemic boundary is passed shortly after turning onto U. S. 22 but it is not exposed. The Middle Kittanning Coal lies near the hilltops and has been stripped at many localities. The Maxville Limestone is exposed in the valley of Jonathan Creek from Fultonham almost to Ohio 93 and has been quarried at a number of points, including the Columbia Cement Corporation operation (STOP 3).

Widely spaced roadcuts expose strata in the lower part of the Pottsville Group. Figure 4 is a sketch of the roadcut on U. S. 22 at the exit to White Cottage, 0. 8 mile north of the Columbia Cement Plant. Figure 5 illustrates the strata seen on U. S. 22 in the roadcut 1. 6 miles north of the Cement Plant.

Jct. Ohio 93 and U. S. 22	4. 7 miles	Roseville exit at Muskingum Co. Road 127; turn left at first traffic light in Roseville, follow signs to Nelson McCoy Pottery Company. STOP 2

Exposures of Pottsville strata and beds of the lower part of the Allegheny Group may be seen in roadcuts along Ohio 93. The Middle Kittanning Coal is stripped near the hilltops, and the Putnam Hill Limestone is exposed 100 yards north of the Roseville exit.

STOP 2
NELSON MCCOY POTTERY COMPANY

The Nelson McCoy Pottery Company is engaged in the manufacture of a wide range of ceramic artware, and a line of dinnerware appropriate for patio use, cookouts, etc. Their salesroom will be open for the convenience of the field trip participants.

This plant started operations in 1910 with stoneware as their principal product. Fire destroyed a large portion of the installation in 1950 and automated machinery was installed when the plant was rebuilt. Raw material which arrives at the loading dock goes through a circuitous production line and is returned to the same loading dock as finished products. Markets for the ware include chain stores, supermarkets, florists, etc.

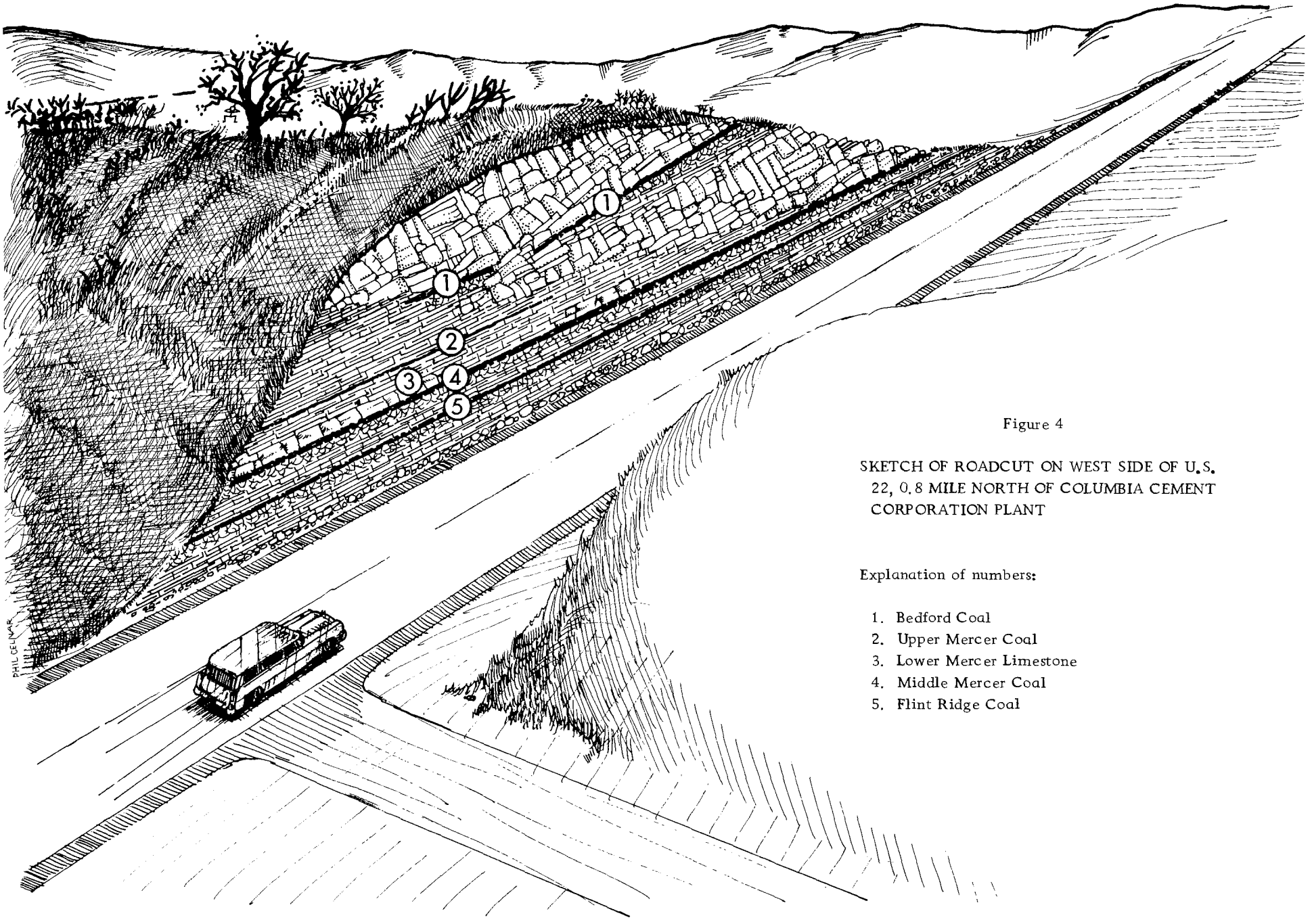

Figure 4

SKETCH OF ROADCUT ON WEST SIDE OF U.S. 22, 0.8 MILE NORTH OF COLUMBIA CEMENT CORPORATION PLANT

Explanation of numbers:

1. Bedford Coal
2. Upper Mercer Coal
3. Lower Mercer Limestone
4. Middle Mercer Coal
5. Flint Ridge Coal

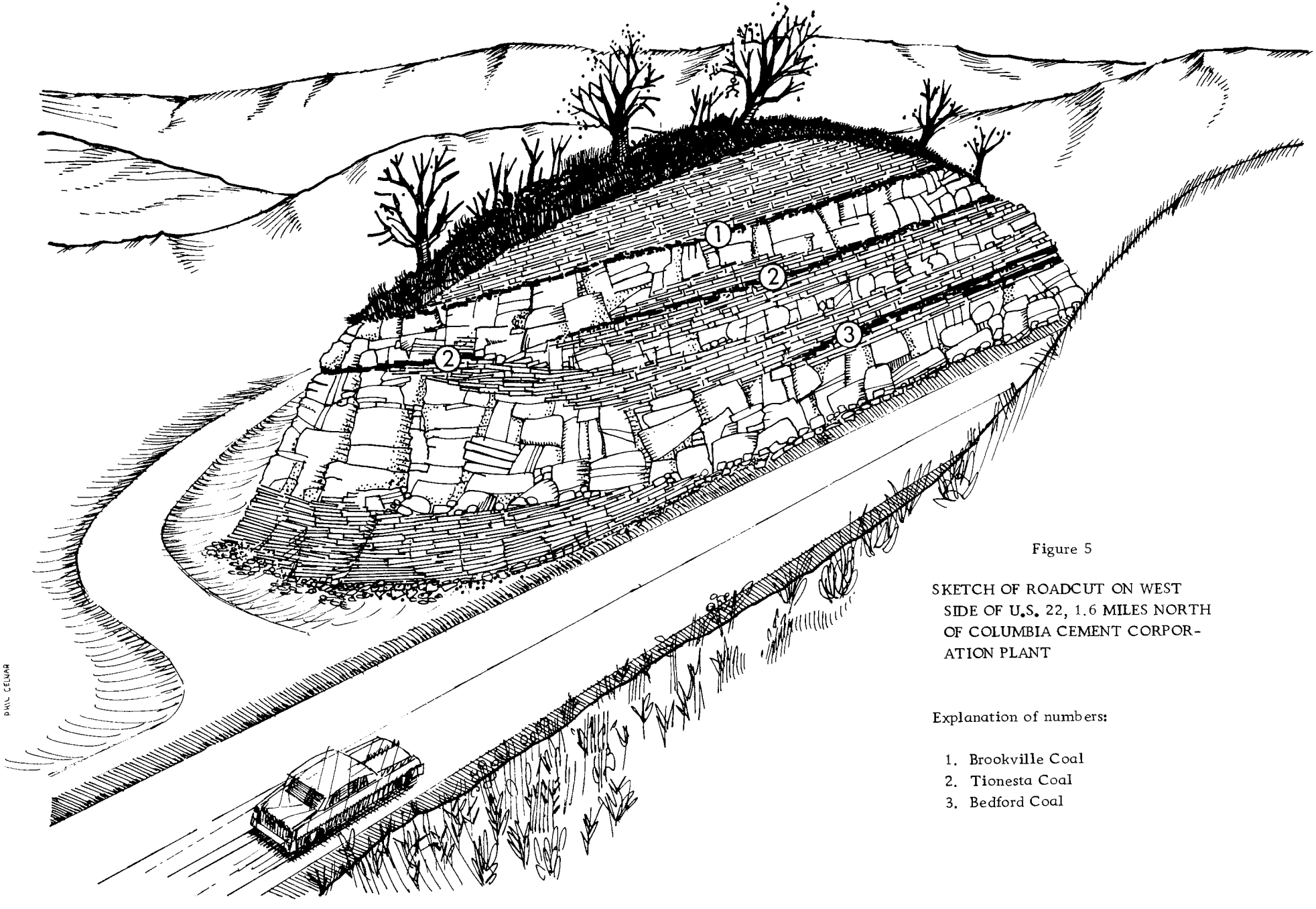

Figure 5

SKETCH OF ROADCUT ON WEST SIDE OF U.S. 22, 1.6 MILES NORTH OF COLUMBIA CEMENT CORPORATION PLANT

Explanation of numbers:

1. Brookville Coal
2. Tionesta Coal
3. Bedford Coal

The ware is formed principally by jigger machines, ram process, and casting. The only items formed by hand jigger are those with handles or pouring spouts. The automatic plate jigger machine, one of the few in operation in Ohio, can form 6,000-8,000 plates in an 8-hour shift. Molds for items made by the ram process and by casting are made of plaster of paris. Two continuous kilns, one straight, the other circular, fire the ware at temperatures of 1800-1900° F. The firing period varies from 32 to 60 minutes.

The bulk raw materials include native clay, "ball" clays from Kentucky and Tennessee, and silica supplied by the Central Silica Company. The native clay is purchased from local suppliers. The clays most extensively used in the Crooksville-Roseville area are the Lower Kittanning and Tionesta (Flint, 1951, p. 39, 46).

Leave Pottery Company at Roseville, return to Ohio 93; turn north Ohio 93 to Jct. with U. S. 22; turn west on U. S. 22	8.2 miles	Columbia Cement Corporation. STOP 3

STOP 3
LUNCH AND TOUR OF COLUMBIA CEMENT CORPORATION'S MINE AND PLANT

The Columbia Chemical Corporation started quarrying operations at this locality in 1919 after acquiring a small, previously opened quarry. Initially, limestone from this quarry was used for the manufacture of soda ash. However, stone below the acceptable size limits for soda ash production soon became a storage problem. Since shale was present immediately above the limestone a decision was made, in 1924, to open a cement plant. This early plant utilized the stone not used for soda ash and had an average production capacity of 2,500 barrels of cement per day. The largest of the two kilns in use here is 450 feet long and $14\frac{1}{2}$ feet in diameter; the other 450 feet long and 12 feet in diameter. The present plant capacity is 10,500 barrels of cement per day.

Raw material for the plant is produced from an underground mine in the Maxville Limestone and from stripping of overlying shales. Currently the mine covers an area of about one by one-third miles, comprising roughly 40 miles of tunnels. Rooms are 30 feet wide by 18 feet high, with 25-foot square pillars being left. Ultimately, 90-92 percent of the limestone in the mine area will be removed. The company estimates about a 70-year limestone reserve. An interesting aspect of the mine is the underground crushing plant and the remote controlled automatic raw material feed system to the plant. During the peak summer months, about 4,500 tons of stone and shale are needed per day.

Because of post-Mississippian erosion, the Maxville Limestone is "patchy" in occurrence along its belt of outcrop. The full thickness of this unit cannot be measured at any one locality, and estimates range as high as 180 feet for its original thickness in the East Fultonham area. Measured section OGS 15039 (p. 13) represents the maximum exposed thickness; maximum known thickness under cover in Lawrence County is approximately 200 feet.

The discontinuous coals and dark shales with irregular sandstones exposed in the shale pit above the Maxville Limestone are typical of the basal Pottsville beds. Details of the stratigraphy at this locality are given in OGS section 15039.

REFERENCES CITED

Bownocker, J. A., 1926, Glass sands of Ohio: Ohio Jour. Sci., v. 26, p. 25-41; Ohio Geol. Survey Repr. Ser., no. 2, p. 3-19.

Flint, N. K., 1951, Geology of Perry County: Ohio Geol. Survey Bull. 48, 234 p.

Field No. _____

Measured by R. M. DeLong

_____

Date March 3, 1966

STATE OF OHIO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL SURVEY

File No. 14898

County Perry

Township Hopewell

Section 4

Quad Glendale 7.5

x _____

y _____

Ref. _____

STRATIGRAPHIC SECTION

Exposure in sandstone quarry of Central Silica Company, SE$\frac{1}{4}$ sec. 4

UNIT	DESCRIPTION	UNIT THICKNESS Ft	UNIT THICKNESS In	TOTAL THICKNESS Ft	TOTAL THICKNESS In
16	Shale, yellow to brown, bedded	5	0	78	0
15	Ironstone layer	0	2	77	10
14	Shale, medium-gray, thin-bedded	4	4	73	6
13	Ironstone layer	0	6	73	0
12	Flint, black; marine fossils; single bed, pinches out at south end of pit. BOGGS	1	3	71	9
	Elevation 1020' HL				
11	Shale, dark, carbonaceous to coaly, thin-bedded	3	2	68	7
10	Sandstone, brown, fine-grained	1	0	67	7
9	Coaly shale, 1' 6"; bone, 4"; coal, 4". LOWER MERCER	2	2	65	5
8	Shale and sandstone	8	6	56	11
7	Coal, blocky, irregular; replaced with sandstone. VANDUSEN	0	8	56	3
6	Sandstone, gray, thin-bedded; varies laterally to sandy shale, micaceous, carbonaceous	18	0	38	3
5	Shale, medium-gray, thin-bedded, micaceous; plant fossils	0	6	37	9
4	Coal; bone at top. BEAR RUN	0	5	37	4
3	Siltstone, light-gray; very fine-grained sandstone at top	2	6	34	10
2	Shale, dark-gray below to medium-gray	4	10	30	0
1	Sandstone; quarried; some limonite staining; massive to irregular bedding. MASSILLON	30	0		
	Elevation base section 948' HL				

Field No. _____

Measured by C. Colson and R. M. DeLong

Date July 25, 1963

STATE OF OHIO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL SURVEY

File No. 15039

County Muskingum

Township Newton

Section 20

Quad Crooksville 7.5

x _____

y _____

Ref. _____

STRATIGRAPHIC SECTION

Exposure in shale pit at entrance to the Jonathan Mine of Columbia Cement Corporation, NW¼SW¼ sec. 20, Newton Township

UNIT	DESCRIPTION		UNIT THICKNESS Ft	UNIT THICKNESS In	TOTAL THICKNESS Ft	TOTAL THICKNESS In
55	Unmeasured shales; in places nodules could be seen to occur about 4' above base		25	0	162	3
54	Limestone, dark-gray on fresh break, yellow on weathered surface; marine fossils. PUTNAM HILL		0	8	161	7
53	Shale		0	2	161	5
52	Coal, bright, blocky. BROOKVILLE		0	7	160	10
51	Clay shale, gray, nonbedded		3	0	157	10
50	Sandstone and shale. HOMEWOOD		5	11	151	11
49	Shale, with dark shale at top; possibly Tionesta Coal zone		11	0	140	11
48	Limestone; marine fossils; averages about 2½'; varies laterally to flint and in places to 1½' of limestone and 1' of ore. UPPER MERCER		3	0	137	11
47	Coal. BEDFORD		0	7	137	4
46	Underclay, yellow-tan		2	7	134	9
45	Sandstone, medium-bedded at base, laminated to thin-bedded upward		1	10	132	11
44	Shale, medium-gray, medium-bedded		5	2	127	9
43	Coal, bright, blocky; local	UPPER MERCER	0	1	127	8
42	Sandstone, carbonaceous, calcareous; plant remains	UPPER MERCER	0	7	127	1
41	Shale, coaly, and shaly coal	UPPER MERCER	1	2	125	11
40	Clay shale, olive below, gray above; slickensides		3	6	122	5

7451
Field No.

File No. 15039

STRATIGRAPHIC SECTION

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UNIT	DESCRIPTION	UNIT THICKNESS Ft	UNIT THICKNESS In	TOTAL THICKNESS Ft	TOTAL THICKNESS In
39	Shale, dark-gray; marine fossils, pelecypods at top	6	0	116	5
38	Limestone, dark-gray, massive, hard, dense, finely crystalline; marine fossils. LOWER MERCER	1	4	115	1
37	Shale, dark, fissile; marine fossils	0	3	114	10
36	Coal, bright, blocky. MIDDLE MERCER	0	4	114	6
35	Shale, light-gray, olive-gray, silty below, slightly silty at top, nonbedded	3	4	111	2
34	Sandstone, medium-gray, fine-grained, irregularly bedded	0	7	110	7
33	Shale, medium-gray, thin- to medium-bedded	8	0	102	7
32	Coal, blocky. FLINT RIDGE	0	3	102	4
31	Shale, massive to thin-bedded upward	2	0	100	4
30	Sandstone, light-gray, very fine-grained, well-sorted, massive, jointed; at north end of pit it measured 8' 2"; very calcareous; coprolites(?); marine fossils; unit pinches out to the south	3	0	97	4
29	Shale, black at base to medium-gray upward, fissile to thin-bedded	7	10	89	6
28	Coal, shaly, sheety type bedding. LOWER MERCER	0	4	89	2
27	Shale, dark-gray, fissile; gradational with unit 26	0	8	88	6
26	Sandstone, light-gray, shaly	1	11	86	7
25	Shale as in unit 23	1	9	84	10
24	Limestone, medium-gray on fresh break, weathers red; varies from bedded to concretionary, mostly concretionary	0	9	84	1
23	Shale, light-gray, thin-bedded; thin discontinuous concretionary layers	3	9	80	4

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File No. 15039

STRATIGRAPHIC SECTION

Page No. 3 of 5

UNIT	DESCRIPTION	UNIT THICKNESS Ft	UNIT THICKNESS In	TOTAL THICKNESS Ft	TOTAL THICKNESS In
22	Limonite, nodular, slightly calcareous; clay inclusions; large Allorisma-type pelecypods. BOGGS	0	1-3	80	2
21	Shale, medium-gray, thin even bedding	5	2	75	0
20	Siltstone, light-gray, massive, with some sand-size material; top is carbonaceous	2	1	72	11
19	Covered	3	6	69	5
18	Shale, light-gray, sandy, thin-bedded	10	3	59	2
17	Limestone, slightly darker than unit 15, argillaceous; slight effervescence with acid; no fossils. POVERTY RUN?	0	1	59	1
16	Shale, medium-gray, thin-bedded	1	3	57	10
15	Limestone, medium-light-gray, massive, iron-stained, hard, very finely crystalline; persistent. POVERTY RUN	0	2	57	8
14	Shale, medium-gray, thin-bedded	1	7	56	1
13	Coal. VANDUSEN	0	1	56	0
12	Clay shale, light-olive-gray; plant impressions and debris, concretionary masses and lumps abundant at base, sparse upward; top 3-4" becomes darker with carbonaceous material; Stigmaria found in upper part	4	2	51	10
11	Shale, medium-dark-gray, thin-bedded, coaly at base, irregularly bedded upward; small ellipsoidal concretions in upper part; somewhat plastic at top; plant fossils	2	0	49	10
10	Shale, coaly; conspicuous layer; slight amount of vitrain; sheety bedding; pelecypods present but complete specimens sparse	0	4	49	6
9	Shale, dark-gray, fissile, sandy, calcareous	3	0	46	6

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STRATIGRAPHIC SECTION

Page No. 4 of 5

UNIT	DESCRIPTION	UNIT THICKNESS Ft	UNIT THICKNESS In	TOTAL THICKNESS Ft	TOTAL THICKNESS In
	NOTE: Details of MAXVILLE LIMESTONE, units 1-8, added to section from description by J. S. Scatterday; described at mine entrance and from a core below mine floor.				
8	Limestone, light-olive-gray, fossiliferous, slightly arenaceous, sublithographic in lower 9-10 feet, medium crystalline in higher beds; beds 0.5-3.5 feet thick, separated by olive-gray, calcareous shale partings 0.25 inches to 0.5 feet thick, some nodules and lenses of limestone in thicker partings; thicker limestone beds divided by thin, discontinuous partings of shaly limestone not readily visible on the outcrop; scattered elongate pellets and oölites in some beds within upper 10-12 feet	20	8	25	10
7	Shale and nodular limestone, medium-light-gray to light-olive-gray; very fossiliferous; limestone finely crystalline to sublithographic, arenaceous	2	9	23	1
6	Shale, very dark-gray; a 0.25 inch thick bed of gray sandstone occurs in the middle of the unit; shale below sandstone is arenaceous	0	8	22	5
5	Shale, light-bluish-gray, slightly calcareous, indistinctly bedded; lower contact very irregular	0.5-1	6	20	11
4	Limestone, yellowish-gray, dolomitic, argillaceous, massive except for inconspicuous, laterally discontinuous laminae; streaks and patches of greenish-gray clay scattered throughout; grades into the underlying unit	3	8	17	3

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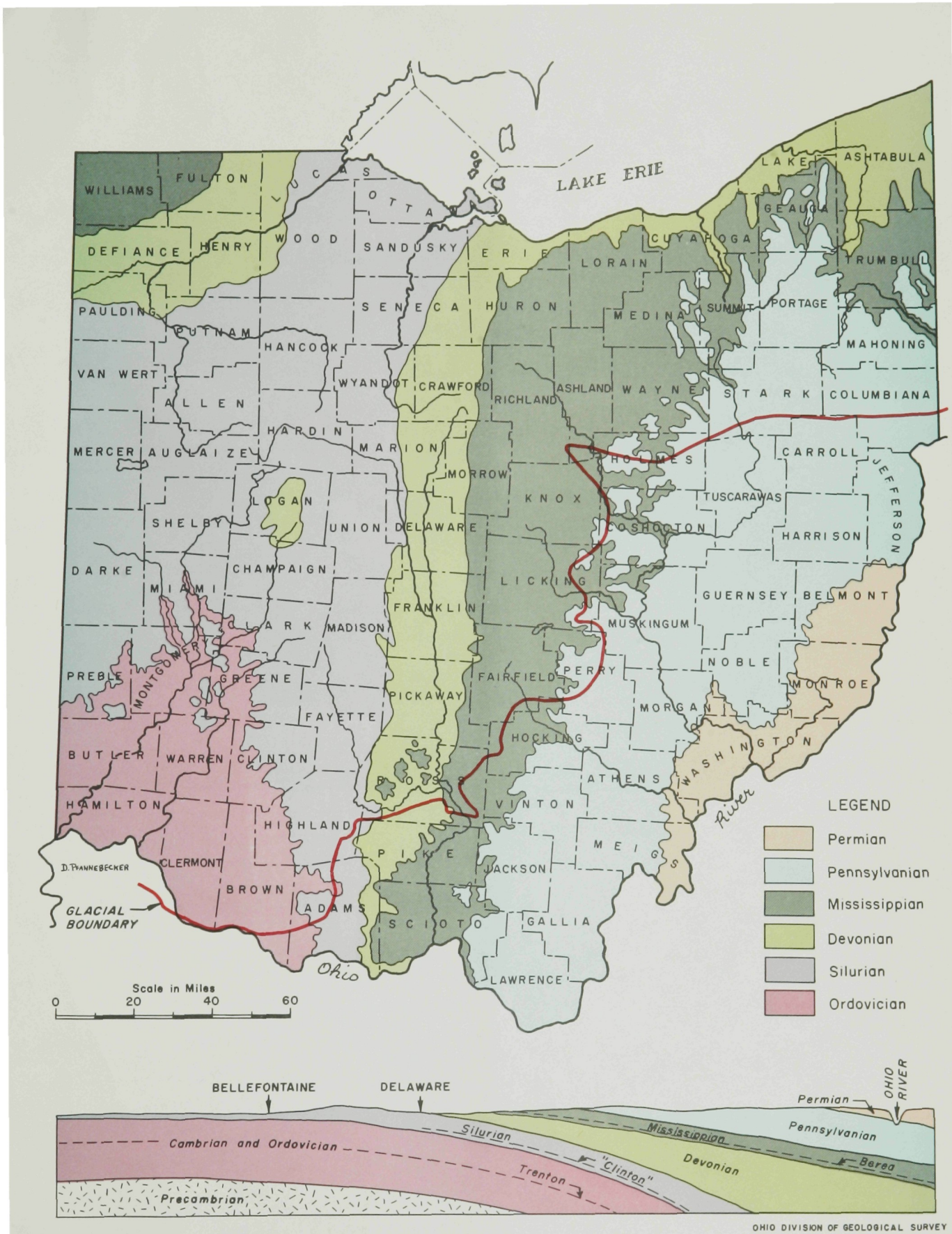
Field No._____

File No. 15039

STRATIGRAPHIC SECTION

UNIT	DESCRIPTION	UNIT THICKNESS Ft	UNIT THICKNESS In	TOTAL THICKNESS Ft	TOTAL THICKNESS In
3	Limestone, yellowish-gray to medium-gray, dolomitic, argillaceous, arenaceous, oölitic, massive; very dolomitic, darker in color, and vuggy at some levels; vugs contain dolomite crystals; grades into the underlying unit	4	0	13	3
2	Limestone, yellowish-gray, dolomitic, argillaceous, arenaceous, massive; grades into the underlying unit	8	5	4	10
1	Limestone and shale, light-olive-gray to olive-gray, sparingly fossiliferous; thin-bedded, but divisions between beds of shale and argillaceous limestone gradational and indistinct	4	10		
	Siltstone and shale, greenish-gray. LOGAN FORMATION				



OHIO DIVISION OF GEOLOGICAL SURVEY

GEOLOGIC MAP OF OHIO